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SOME OF CHINA'S PHYSICAL PROBLEMS

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Physical well-being is the basis of national, as well as of individual life, in all its other aspects. China today faces an almost overwhelming gamut of problems, political, economic, social, industrial and educational. Many of them demand immediate solution, or at least, immediate attack. Some of the most pressing of these are what I would call physical.

There is not time, and I would not be qualified if there were time, to give anything like a comprehensive discussion of the various physical problems that China faces. But in journeying widely throughout China during the last nine years, I have observed some of the surface aspects of several of these problems. These I shall try to present to you chiefly by means of the photographs I have secured.¹

The primaries of an individual life are food, shelter and raiment. The primaries of a national life are these for all the people plus ways of communication and transportation.

The poverty of the people is one of the most striking aspects of life in China. Yet their industriousness is almost quite as striking. For most of them it is a tremendous struggle with no leeway. This results partly from the over emphasized necessity of producing progeny to do honor to the family ancestors, leading to the practice of early marriage and of polygamy, giving rise to over population without any disposition to migrate to less populated areas, nor indeed are there the facilities to do so or the knowledge of other parts that would invite such migration. These factors, combined

¹ The lecture was illustrated by a hundred slides mostly taken by the author.

with a ruinous policy during many centuries of using up all available timber, so that now almost everywhere the hill-sides are not only bare of trees but are literally scratched for roots each season, have so decreased the margin which the people have between a state of enough and that of utter want, that when the floods come, which they do almost annually in certain sections as a result of this ruthless deforestation, vast numbers are subject to actual famine.

The remedy is threefold: First a reduction of the birth rate as general education advances and a saner sociology prevails.

Secondly, a comprehensive system of reforestation, for from a physical point of view the primary fact about China is that she has used up her trees. Reforestation on a small scale has been begun in some parts but much more needs to be done and the need for it must be made clear and appropriate measures approved and financed.

Thirdly, improved methods of agriculture must be introduced. What is needed is more extensive farming. The Chinese farmer is altogether a gardener. He is the world's best expert in intensive farming, and we can learn from him in that line; but he seems to know little of extensive farming as we know it in the West, or of the ways of improving varieties. Modern agricultural schools are being established and some large agricultural development schemes have been formed. We may expect to see considerable progress in due time. I would commend to you the late Professor King's "Farmers of Forty Centuries," and G. W. Groff's pamphlet, "Agricultural Reciprocity between America and China."²

I believe that one of the best examples of re-forestation is given by Denmark in which in the course of twenty-five years, a considerable area has been given full-grown trees of a quick-growing variety and the rainfall has already been markedly affected. It is not likely that the same conditions exist in China so that it will be at least two or three generations before the conditions with reference to re-forestation

² Either of these can be secured from the Trustees of the Canton Christian College, 156 Fifth Avenue, New York.

can be adequately altered. There must, in the meantime, be a survey of flood-subjected areas of the rivers involved so that the adequate measures of protection may be carried out. During one of my recent trips in Anwhei Province, one of the regions of chronic famine, I met the American engineer, Mr. Jameson, who had been sent by the Red Cross Society for the purpose of determining in what way such protective works might be carried out, and I have noted recently in the press that President Taft has commended Mr. Jameson's report to President Yuan Shih Kai. But this task of determining what should be done for the control of the rivers and canals is a gigantic one and needs the attention of the world's best experts.

Chief among the rivers needing such control is the Yellow River, "China's great sorrow." This is but little inferior to the Yangtze in length, being nearly 2500 miles, running from southwest to northeast. But is one of the most unmanageable rivers in the world and of little utility. It is a characteristic river of the loess region, with a broad shallow course which is apt to change. It owes its color and name to loess sediment. During the whole known historical period, this river has frequently changed its course for the last 350 miles. These changes have swept over a fan-shaped areas of 60 degrees in one of the most densely populated and highly cultivated regions in all China, and have, consequently caused great loss of life both directly by flood, and indirectly by consequent famine through destruction of standing crops as well as of stored food supplies.

Throughout its whole lower course, its waters run through the plain where it is most to be dreaded, because the mud and sand carried down by its stream have actually raised the bed of the river until it is several yards above the level of the surrounding country. Consequently there are few important towns on its banks. At its crossing with the Grand Canal, its bed is 16 feet above the level of the Canal.

In 1642, the city of Kai fung, 350 miles inland, was submerged 20 feet, and 200,000 persons are said to have perished. In 1854 the river flowed into the Yellow Sea in latitude 34 degrees N, but in that year it diverted near Kai fung fu, into

a northern bed it occupied 550 years before, and joining the Ta tsing ho, discharged into the Gulf of Chihli, several hundred miles further up the coast. In 1887 a terrible inundation occurred by the river bank giving in, and towns and villages were swept away.

To hinder its overflowing, embankments hem it in, some nearer, others farther, ranging one behind another at variable distances. In this manner, if one gives way, another prevents the inundation. In its present state, the work is still very inefficient, the dikes being weak, and constructed with materials that offer insufficient resistance.

The mud and sand which frequently obstruct the Yellow River, render it also very difficult of navigation. The only portion where it can be availed of, is to the north of Honan, and in the last 25 miles of its course. But even in this part, a shoal prevents junks except of very light draft from passing.

The flow of the Yellow River varies much with the season. It has been reckoned to be a little over 4000 cubic yards per second, in its middle portion, near Tsinan Fu (Shantung). The flow is three miles greater in the flood season. It is on the whole relatively small for such a great river, but this is partly accounted for by the waste of the water that filters through the embankments. The mud and sand, which it unceasingly deposits in the Gulf of Chihli, constantly lessen the depth of the latter, and form there new alluvial lands. Opposite the former mouth of the river (1851) one can see what great quantity of sediment was carried in its waters.

The last serious breach in its dykes occurred in September, 1902. The Chinese engineers showed great ingenuity in effecting its repair. The breach was near Liu-wang-chuang and was 1500 yards, through which most of the river flowed. It was repaired by building out from each side, dams in the form of a series of pakwerks of kaoliang stalks and sacks of clay, each pakwerk or buttress being joined to the previous one by ropes and piles.

Kaoliang is a kind of sorghum, probably identical with Barbados millet. The core of the stalk, except for a very thin and weak covering, is entirely pith, but it has a matted

bunch of fairly hard and strong roots which form its chief virtue for construction work. The stalk is about 6 feet long, $\frac{3}{4}$ inch in diameter, and the bunch of roots, 3 to 5 inches in diameter. The face of the work including the sides is composed of the roots which mat together and make a splendid surface for keeping out water.

The final opening in this breach of 1500 yards, after pakwerks were built out from each side, was reduced to 55 feet, and this, after two disastrous attempts in which the lives of many workmen were lost, was effectively closed on March 16, 1903, by letting down a huge mattress of kaoliang stalks and sacks of clay, the mattress being anchored to the side of the river by a great many 15-inch hawsers so as to prevent canting due to impact of current. Over one hundred 8-inch ropes spaced closely together were stretched across and belayed to anchor piles. On these were then placed in alternate layers the kaoliang stalks and sacks of clay. When these materials reached the level of the sides of the dam, the ropes were manned, and at a given signal were each lowered 1 foot on each side.

The rush through the opening was reduced by the construction of a deflecting groyne on the up river side of the breach, constructed similar to the pakwerk, and projecting some 120 feet into the current. The width of the river channel abreast of the breach had been 600 feet but was reduced to 300 feet by the formation of a sand bank on the opposite side of the river.

The control of the Yellow River is today one of the most pressing of China's physical problems. Experience has shown that the diking of such rivers is insufficient and almost futile. Captain William Tyler, coast inspector of the Chinese light house service, has presented a report on the Yellow River published by the inspectorate-general of customs at Shanghai in 1906, in which he proposes to control the river's lower reaches by providing for the depositing of the silt by deliberate flooding of large areas along the river, that is, to regulate its floods.

For this as well as for other rivers subject to floods, very comprehensive surveys should be made and the history of

the streams involved secured as accurately as possible. It has been surprising to me to see how often the railway engineers have erred in China, from their inadequate attention to this factor of river history, and after costly experience have had to redetermine the level of their tracks when flanking a river or lake or to rebuild their bridges crossing a stream.

Another example of Chinese engineering skill employed in protecting the land from the "misbehavior" of rivers is the great sea wall along the north side of Hangchow Bay, of which I have elsewhere given a full account,³ and is, considering the difficulties under which it was built, one of the finest pieces of such engineering to be found anywhere.

The Hangchow bore is caused chiefly by the funnel-shaped character of Hangchow Bay, combined with extensive mud and sand bars that occupy its mouth so that the tide in coming up the bay instead of gradually rising, banks up near the entrance. The difference in level is such that a great wall of water anywhere from 10 to 30 feet in height rushes up the bay and up the river at a speed which sometimes equals that of an ordinary express train. This occurs twice a day and always amounts to a considerable wave, although sometimes it is much larger than others. Of course, an exceedingly strong wall is required to keep out such a mass of rushing water from the surrounding country which, as a matter of fact, is in many places below the level of the river. Some 750,000 taels are spent each year for the upkeep of this wall. It is built of heavy granite blocks joined together with double iron wedges and besides the wall which is ordinarily 30 feet in height, there are two granite platforms or ledges each edged with a multiple series of long piles driven into the sand, constituting one of the strongest sea footings that could be secured to keep the wall from being undermined. At intervals of about half a mile for a good part of the wall, there are *pakwerk* buffers to deflect the current of the bore.

As if these two cases of the devastating forces to be overcome were not enough to develop resourcefulness and hardihood in the people compelled to face them, the coast of

³ *Popular Science Monthly*, February and March, 1908.

China is subject also to frequent typhoons, many of which are destructive of life and property in the extreme. I shall attempt no description of the typhoon and its origin, but wish by my pictures to call attention to the tremendous destruction caused by such storms.

In order that there may be more timely warnings, there are needed more observatories and better coördination in the work of existing observatories throughout the Orient. There are, at the present time, well-established observatories at Zikawei near Shanghai, maintained by French Jesuit missionaries; at Hong Kong, maintained by the British colonial government, and at Tsintau, the German concession on Shantung promontory. These observatories are more or less in receipt of communications from the observatories at Manila and Tokio, and there are also observations of more or less regularity at various light house stations along the China coast and at some of the ports by the harbor masters in the customs service. But, there is a great deal more than this to be done, and the whole work needs to be put upon a sound basis in its scientific work and in its administration.

One of the best things that Sir Robert Hart did in connection with the customs service was to give the China coast its needed light houses, so that today it has a chain of such that will rival those found anywhere.

The country at large needs also a weather service. While this is primarily the government's duty, missionary colleges at the present time have a real opportunity to assist China in this connection. The physics department of each of the colleges throughout the land should make adequate and systematic meteorological observations so that when the time comes when the government is able to organize a service on its own basis, there will be qualified observers available and an accumulation of valuable data upon which valid generalizations as to the meteorological forces in China may be based. All this is closely connected with re-forestation, extensive farming and the control of rivers. There should be a thorough meteorological survey as a necessary preliminary if these problems are to be adequately solved, for it will require at

least twenty years to gather the data that will render generalization valuable.

Partly as a preliminary to this, the Carnegie Institution of Washington has for over six years been carrying on magnetic observations throughout China in accordance with plans which I submitted to them to be carried out in connection with their magnetic survey of the North Pacific, and I shall treat briefly of the aims, scope and results of this magnetic survey as a distinct contribution to the solution of China's physical problems. The results of such a survey are necessary to the land surveyor and to the navigator in order that when a magnetic compass is used either to steer a ship at sea or to run the lines of a survey on land, the user may know the amount accurately by which the needle deviates from the astronomical or true north. At each station, the observer determines latitude and longitude by astronomical observations; the compass deviation or declination, the dip of the magnetic needle and the intensity of the earth's magnetic force at that place. All these elements are necessary in order to predict the way in which the magnetic declination from the north will vary with the years. The Carnegie Institution of Washington has extended its operations to China as a part of its plan to supplement the work of the constituted governments, who have not yet organized scientific services. Already fifteen of the provinces have been traversed and about a hundred stations have been occupied at intervals varying from 25 to 100 miles. The results for the years 1905-1910 are just being published and had previously in part been made available to those chiefly interested. Only three of the most western provinces and the greater part of Mongolia remain to be covered in this preliminary reconnaissance.

Connected with this matter of surveys is the whole problem of reform in weights and measures in China which are in utter confusion today. But while really a part of your topic, I shall not attempt here any discussion of this item.

During my survey trips I have of course come to appreciate very feelingly the problem that China has with reference to

roads. The pictures show you a few typical cases which will indicate what a boon good roads would be and how much railroads would relieve conditions at present so hard to bear. In the south there are no roads only footpaths. In the north the cart roads are so ancient and worn that in the loess regions they are veritable ruts—sometimes as deep as 70 feet below the level of the land on either side.

One reason why roads have been neglected is the prevalence of waterways, especially in the Yangtze and Canton deltas, and throughout the whole country great use is made of even insignificant streams by boats of very shallow draft. All these should be improved by proper conservancy methods.

Of special importance in this connection is the Grand Canal, the oldest and longest of canals. As the chief artificial waterway in China I wish to present to you something of the history and present condition of this canal, illustrating this latter aspect with a number of photographs secured a few years ago when I made a trip in a house-boat all the way from the Yellow River to the southern terminus of the canal at Hangchow, about 700 miles.

The Grand Canal, called in Chinese Yü-ho (Imperial River), Yün-ho (Transport River,) or Yunliang-ho (Tribute-bearing river), extends from Hangchow in Chekiang to T'ientsin in Chihli, a distance of about 1000 miles.

According to the most reliable accounts, it was commenced in the sixth century B.C., and finished in only A.D. 1283. The most ancient part is that which lies between the Yangtze and the Hwai-ho. The southern part, extending from Hangchow to Chinkiang, was constructed from A.D. 605 to 617. The upper part, extending from the old bed of the Hwang-ho to T'ientsin, was constructed by the Emperor Shi Tsu of the Yuen dynasty, and completed within a space of three years (A.D. 1280-1283). Shi Tsu then transferred his capital from Hangchow to Peking. As the northern provinces were not very fertile, and the trade along the seaboard unsafe, he was forced to get provisions from the southern provinces. He therefore resolved to complete the work left unfinished by his predecessors.

The southern portion, extending from Hangchow to Chinkiang, offers no difficulty as to its water supply. The slope is gentle and water is plentiful. Navigation on it is easy. Boats are sometimes retarded by bridges, but there are neither rapids nor locks to pass. The flood and tides of the Hangchow River are the only obstacles to overcome. Of the Bore Wall that does this, I have already spoken.

The central portion extending from the Yangtze to Ts'ingkiangp'oo is the most ancient. This part skirts several large lakes. It was formerly fed by the Yangtze, and its stream flowed in a northwest direction. It is fed at the present day by the waters of the Hwai-ho, as they issue from the Hungtseh lake, and the stream runs in a northerly direction. The current is fairly strong. The level of the country lying to the west of the Grand Canal and called the Shangho (above the river), is higher than the bed of the canal, while the country to the east, or Hsia-ho (below the river) is lower. Waste-weirs constructed on the eastern embankment, and opening on the Hsia-ho, discharge the surplus waters in the flood season, and thus relieve the banks and hinder injury of the works. There are few bridges in this portion of the Canal, but numerous ferry-boats facilitate passing at almost every place. This part of the Canal is far from offering the same advantages for navigation, at least, when one proceeds northward, as the southern portion. Boats, however, can easily travel on it and as on the southern section launch trains are regularly maintained.

The northern portion, extending from Ts'ingkiangp'oo to T'ientsin, is the most recent and also the most difficult for navigation, and hence the least utilized. Between the Ts'ingkiangp'oo and the Hwang-ho, the Canal is fed from the Hwai-ho and the Wen-ho. Its highest point is at its junction with the Wen-ho, just south of the Yellow River.

The current flows in a northerly direction from the junction of the Tawen-ho with the Grand Canal at Nanwang. The passage of the Hwang-ho is difficult. If the water fails to rise $7\frac{1}{2}$ feet beyond the ordinary level, junks are unable to cross it. If it rises higher, the current becomes too strong, and so travelers must at times wait a whole month before an

opportunity offers to cross it. At Lints'ing, the Canal joins the Wei-ho, borrows its channel, and is again easily navigated. From Ts'ingkiangp'oo to Lints'ing, the Canal is navigable with difficulty. Water is often lacking, and the locks or *chah* (such is the term applied to the narrows that stem the velocity of the current and establish a difference of level above and below) constructed to remedy the drawbacks, are passed with difficulty. On the up-voyage the boat must be hoisted by means of hawsers, while in the downward trip, it must be kept in check. There are numerous capstans, and hands are not wanting (about eighty or one hundred men are at work at times), nevertheless, the operation is not performed without trouble and risk of mishap.

The tribute fleet, which carried the rice to Peking, formerly followed this way, and comprised 4000 to 5000 boats divided into sixty-five sections. The voyage was performed but once annually. Of late years, the grain dispatched to Peking is largely forwarded by the sea route, through the agency of the China Merchants' Steamship Company.

As a means of communication between north and south, this part of the Canal is at present of little value, as it is defectively constructed, silted up by the mud-laden waters of the rivers crossed, and rendered ineffective through official neglect. But it could be restored to usefulness and be of considerable value.

In its southern and central portions, the Grand Canal, although badly kept up, is much more utilized, and several thousands of boats traffic on it. From Ts'ingkiangp'oo to T'ientsin, travelers frequently hire carts which jolt them on to Peking. But this is precisely the part I was most interested to traverse.

Numerous officials were formerly entrusted with the up-keep of the Grand Canal, under the control of a director-general of the grain transport, or Ts-aoyun Tsungtuh. This official was of equal rank with the viceroys. He resided at Ts'ingkiangp'oo, as well as his first assistant, who bore the title of tribute Taot'ai, or Ts'ao-Hot'ai. The office of director-general of the grain transport was abolished in January, 1905.

The pictures illustrate the details of the locks and their method of operation. They also show the delapidated condition of the locks in certain places and the bad condition of the canal elsewhere.

The ordinary canal lock consists of heavy granite bastions, forming a gateway and carrying on their opposing faces deep grooves in which are set heavy timbers to form a dam. These timbers are raised by means of heavy stone set capstans, and by closing any one dam on the opening of the one above it, enough water may be available until the downcoming boats have been enabled to navigate the shallows between it and the upper lock. Boats of shallow draft are able to go down on the flood and to navigate the shallows below this lock by the backing up of the water in the rear of the next down-canal lock, ascending boats being tracked up against the flood.

Because of its position and the ease with which, from an engineering point of view, it could be put in a proper working condition, it seems to me very important that the Grand Canal should be improved and thus afford a cheap method of transportation for a large section of the country even in addition to what railways may in the course of time be developed. The Chinese are such natural boatmen that I think they would take easily to the handling of boats on the Canal even with modern locks and modern towing methods and machinery.

One of the most remarkable developments in the way of more rapid transportation in China has been the installation of so-called "launch trains," especially in the middle and lower sections of the Grand Canal and even more so throughout the Canton delta. For instance, in the custom house at Canton hundreds of steam launches are registered as towing between it and neighboring villages, anywhere distant from 10 to 200 miles. These launches often tow two or three passenger barges in a line and are exceedingly well patronized both for passengers and for freight. Launch building ship yards have been rapidly developed in Shanghai, Canton and elsewhere. But, for the more rapid and adequate development of that ease of communication upon which so much

depends for the binding together of China, we must look to the railways.

Railroads and other ways of transportation of commodities are related to the life of a nation in pretty much the same fashion as the circulatory or blood system of the human body is related to the life of the individual—similarly the lines of electric transmission of intelligence and the postal lines correspond pretty closely to the nervous system whose functioning is so intimately a part of our bodily life. Each of these systems, the circulatory and the nervous, has a dominating centre which has a relationship of mutual dependence with all parts of the body and all functions of its life. No part can live alone. So the development of national life in China depends necessarily largely upon the development of these two systems within her borders,—that for the easy, cheap and rapid distribution of commodities, so that the people of one region may almost instantaneously relieve the hunger or want in another region, and that for the quick and effective transmission of intelligence which will cause the thrill of the new national life to be felt in the remotest parts and by every individual.

Consequently, some indications of what has been done and what still remains to be done in the way of development of railways in China will be of interest.

At the present time there are the following main lines already in operation:

The system from Peking to Newchang and Mukden, via Tientsin and Shankaiwan which in turn is affiliated or connected with the Japanese railways in southern Manchuria and by them in turn connected with the Trans-Siberian Railway. It is of this Peking to Mukden line that Dr. C. C. Wang, who spoke to us so eloquently yesterday afternoon is an associate director. There is also the line from Peking to Kalgan and the Great Wall, constructed entirely under native direction.

Second, the Peking to Hankow line crossing the Yellow River by one of the most wonderful of bridges and over which each week a train de luxe runs that will rival the best trains in other lands, making the journey in about twenty-eight

hours. From this main line there also runs a connecting line westward to Taiyuanfu, the capital of Shansi, traversing a region very rich in soft coal. There is also the cross line connecting Kaifeng with Honanfu.

Third, the German line in Shantung from Tsingtai to Tsinanfu where it now in turn makes connection with the most recently constructed road from Pukou to Tientsin which at its southern terminus on the Yangtze is just opposite Nanking and thus virtually connects with the railroad from Nanking to Shanghai and Hangchow.

Fourth, the French railway from Tonkin north-westerly to Yunnanfu, the capital of the Province of Yunnan, which has in my judgment been the most difficult of all to construct and the most costly in lives as well as money, and very costly to maintain on account of the frequent heavy landslides. Dear as it has cost it has, however, won for the French the domination in the trade of Yunnan. They have beaten the British who were so slow in constructing a road into Yunnan from the Burmese border. But the proposition is entirely a different one. This line from Burma would have to traverse at least two river valleys which are very difficult to cross while the French line running northwesterly has had a comparatively easy time in following up the Red River and one of its tributaries. Having seen for myself the difficulties which have been encountered in this easier route I am almost persuaded that the difficulties of the other could be taken as practically insurmountable except at most prohibitive expense.

Fifth, the British-Chinese line from Kowloon (Hongkong) to Canton, the last of the major roads which has been fully completed.

There are of course several minor roads, such as the American-built line from Canton westward to Fatshan and Samshui, the Japanese-built line from Swatow to Chowchowfu, the Shanghai-Woosung line, the Nanking City Railway, and others.

More important than these, however, are the other main trunk lines projected and in part already constructed. Most of the railroad development thus far has been confined to the

north-eastern quarter of the country. Lines connecting the north with the far south and the east with the far west are imperative and some progress is being made toward their realization.

First among these we should mention the Canton-Hankow line which with the road northward from Hankow will give an all rail connection from the metropolis of Kwangtung to the national capital. Although begun over a decade ago under the auspices of the American-China Development Company, less than a hundred miles of this road are as yet in operation. The original holding company because of their failure to keep the explicit conditions on which the concession was granted was obliged to sell out to the Chinese government, and American prestige in China suffered a severe blow. I have traversed the route of the proposed line and consider it one of the very finest propositions for the development of a coal bearing region.

Second among these projected roads, as yet but partly built, is the very important line from Hankow westward into Szechuan which will obviate the tremendous difficulties introduced by the gorges in the Yangtsze.

Another important line projected is that from Yunnanfu to the Yangtsze at Chungking.

There are many others but where the capital is to come from is a great problem. Most of the roads already built have been financed by foreign capital on the basis of concessions and some have already been handed over to the Chinese government for administration henceforth. Others have been joint enterprises in operation. Others are still completely foreign concessions and are operated as such. Only a small part of the development has been under entirely native auspices.

A good deal of the apparent opposition to the construction of railways in China on the part of the people has grown out of violation of the ubiquitous graves rather than from any inherent objection to the railway itself.

The people have now come fully to appreciate the advantages of railways and as we have already heard in this conference it was the imperial government's policy with refer-

ence to railway administration that was the operating factor in starting off the revolution in Szechuan. Dr. Sun Yat Sen is now devoting all his time to the promotion of railways. Doubtless there will be within a reasonably short period tremendous development of railways in China and they in turn will have a tremendous welding effect upon the country. It is necessary that within her borders there should be developed well equipped technical schools in which the Chinese may be taught the arts and sciences necessary for the construction and maintenance of railways and other works.

There is hardly time to refer in detail to the development of the postal system or telegraph lines in China, except to point out the tremendous success with which the postal system has been developed in that full-fledged post offices with the various departments are in operation all over the country and that a letter can be sent anywhere for the sum of 1 cent of our money, and that within a radius of about 60 miles from Canton for instance, it may be sent for one-quarter of an American penny.

Telegraph lines connect all provincial capitals with Peking and this system is being extended. It is not thoroughly understood as yet by all the people just how these things work and I am reminded of two instances which have come under my own observation to illustrate this.

An old man in Shantung hearing of the function of the line of wire that ran across his fields declared that men who could devise such a method for the transmission of intelligence could do anything; wherefore one of his neighbors remarked that he did not think much of it, for he himself had sat for two weeks watching that line very closely and had not yet seen anything go by.

The other instance was of Hunan carrying coolies tossing their worn-out straw sandals on the telegraph lines to secure for themselves a fleetness of foot equal to the speed of the electric message.

The telegraph and the postal system have already, in combination with the development of the public press in China, done a great deal toward unifying the people and may

confidently be counted on for a much larger effect in the future and this combined with more adequate railway facilities will surely foster a greater feeling of nationhood and of closeness of relationship between the various provinces.

We have seen something of the various physical problems which China faces. It is significant that the greatest physical feat of the ancient Chinese, the Great Wall, which was executed to shut out foreign intruders, has been broken down in all essential respects, and China is today fairly ready for foreign assistance in solving her problems, if it be friendly and not predatory.

The solution of Chinese physical problems largely depends on education; the education of the people to furnish the background of general enlightenment and the education of the native leaders upon whom must rest the responsibility for carrying out in detail such plans as may be formed for the alleviation of the conditions I have referred to. In order to determine just what remedial methods should be followed, there should be first a thorough study of present conditions by the best consulting engineers and scientists who can be secured. There is at the present time, it seem to me, a most important function for foreign experts to fill in connection with the development of China, and their work is a necessary preliminary and hence it is all important that China seek and use the assistance of such men, although it is also true that her need for such assistance will be temporary, and the application of the remedies, which they in their wisdom suggest after a study of the field, will still depend upon native talent.

The new national flag of China embodies, I believe, some significant lessons in the present connection. The sewing together of five stripes of silk to form one flag is easy, but to make a united nation of five peoples so widely separated, linguistically and geographically, in a country so greatly accidented by mountains, and so harassed by flood and famine, and so lacking the ways of quick transport and general modern education which must precede the development of resources and of ways of communication, requiring native captains of industry and native leaders of all sorts—a very

much greater task. It is just here that one of the functions of our mission colleges in China comes in—to train these leaders *in situ*, without loss of connection with China; for they need to know China as well as Western science and institutions and methods. They need to be qualified and unselfish, then the five points of the compass assumed by the Chinese may be rightly adopted—for the north, east, south and west will then all be *centered* around the common pole of service to China, and from the provinces to Peking and from Peking to the most distant provinces, the people will be united in an efficient, peaceful and helpful state, at least within the boundaries left them by their at present more powerful and predatory neighbors.